

# Forest Savanna Mosaic in Lope Reserve of Gabon: A Remote Sensing Study

Sasan Saatchi, Lee White, Kate Abernethy

## Abstract

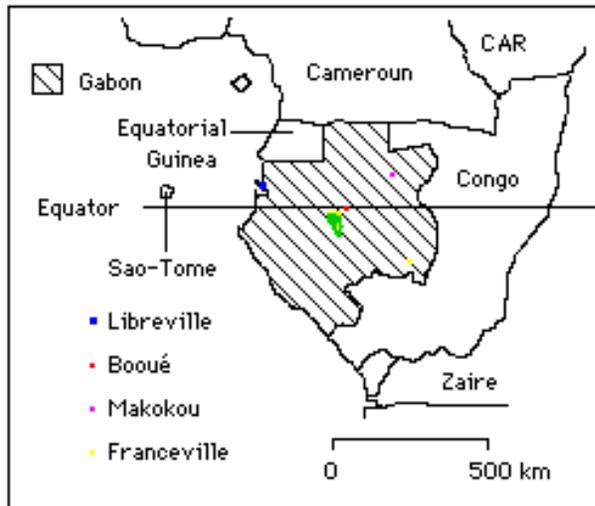
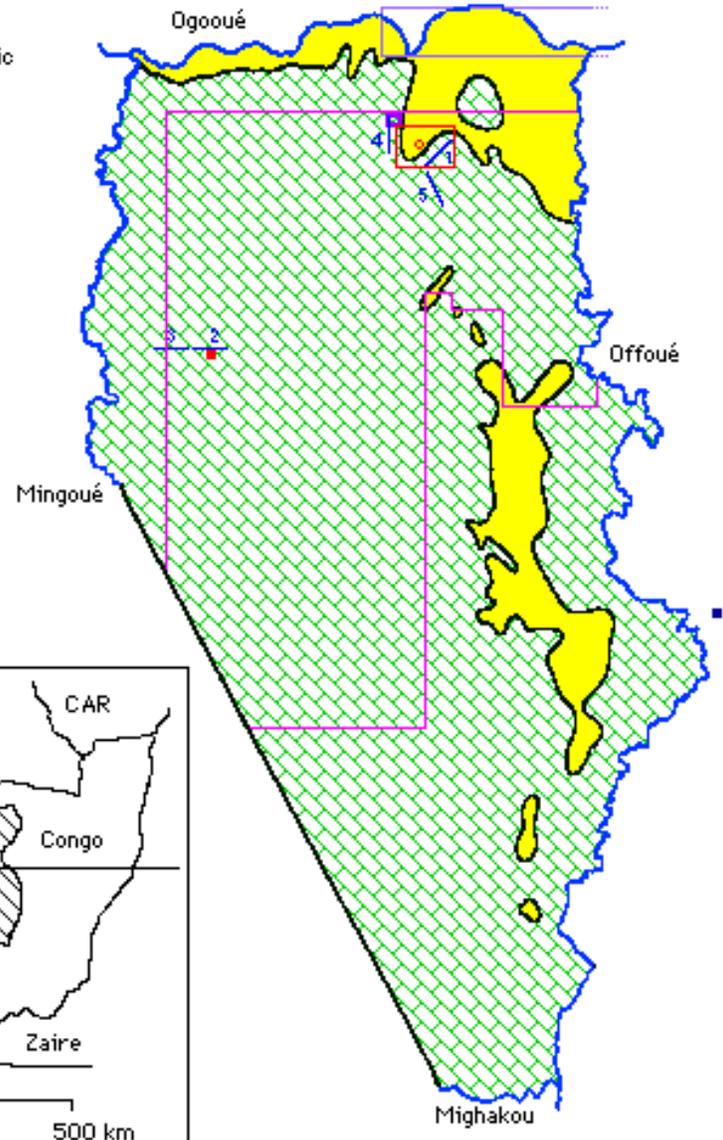
Lope Reserve in Gabon has been the center of many biological studies of flora and fauna in Central African rain forest. The reserve is located in central Gabon and includes savanna areas enclosed by the rain forest. The forest savanna mosaic in the north of the reserve and their dynamic landscape features have become the source of many botanical and ecological studies in the region. Furthermore, the reserve is enclosed by areas under intensive logging activities and therefore threatened by encroaching fragmentations. Mapping the vegetation cover of the reserve and monitoring the forest and savanna boundary and the fragmentation caused by logging has become an important factor in understanding and sustaining the biological diversity of the reserve. In this paper, we use a series of radar remote sensing images to map the vegetation types and to develop a monitoring protocol for the reserve. A decision rule classifier based on radar backscatter and multiscale texture images are used to map the vegetation types. SIR-C/X-SAR data were used for mapping the savanna and rain forest vegetation and the JERS-1 and ERS-1 data were used to map the entire reserve for general vegetation types. The accuracy of radar derived vegetation maps were established by comparing the results to field data, Landsat imagery and existing maps.

## Introduction

### Study Area

The study area covers about 50 km<sup>2</sup> located in the northern part of the Lope Reserve (0° 10' S, 11° 35') in central Gabon (Figure 1). Lope lies in an area of low rainfall compared to the rest of Gabon. Mean rainfall at the SEGC (Station d'Etude des Gorilles et Chimpanzes) center is 1506 mm (1984-1992) with considerable inter-annual variations in the amount and distribution. Most of the reserve is covered by semi-evergreen lowland tropical rain forest with a large areas of forests-savanna mosaic and gallery forest along its northern boundary. In the early part of the dry season (July, August) most of the savannas are burned for management purposes. Areas protected from fire are being actively recolonized by forest. January and February is also generally dry but does not

-  Forest - Savanna Mosaic
-  Forest
-  Proposed Core Area
-  Descoings Study Area
-  Harrison's Study Area
-  SEGC
-  SEGC Study Area
-  Reitsma's Plot
-  Transects 1 - 5
-  Makandé



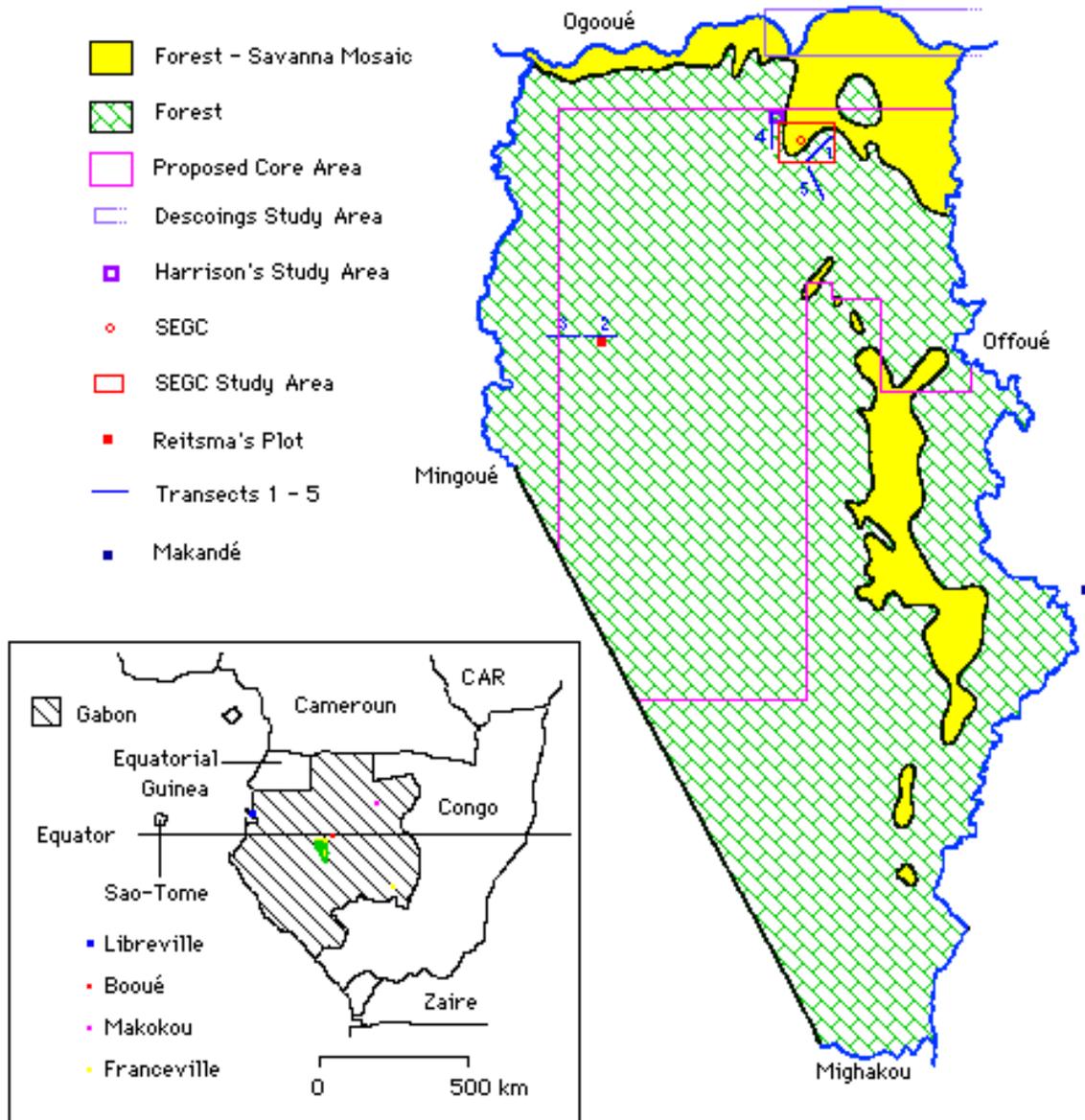
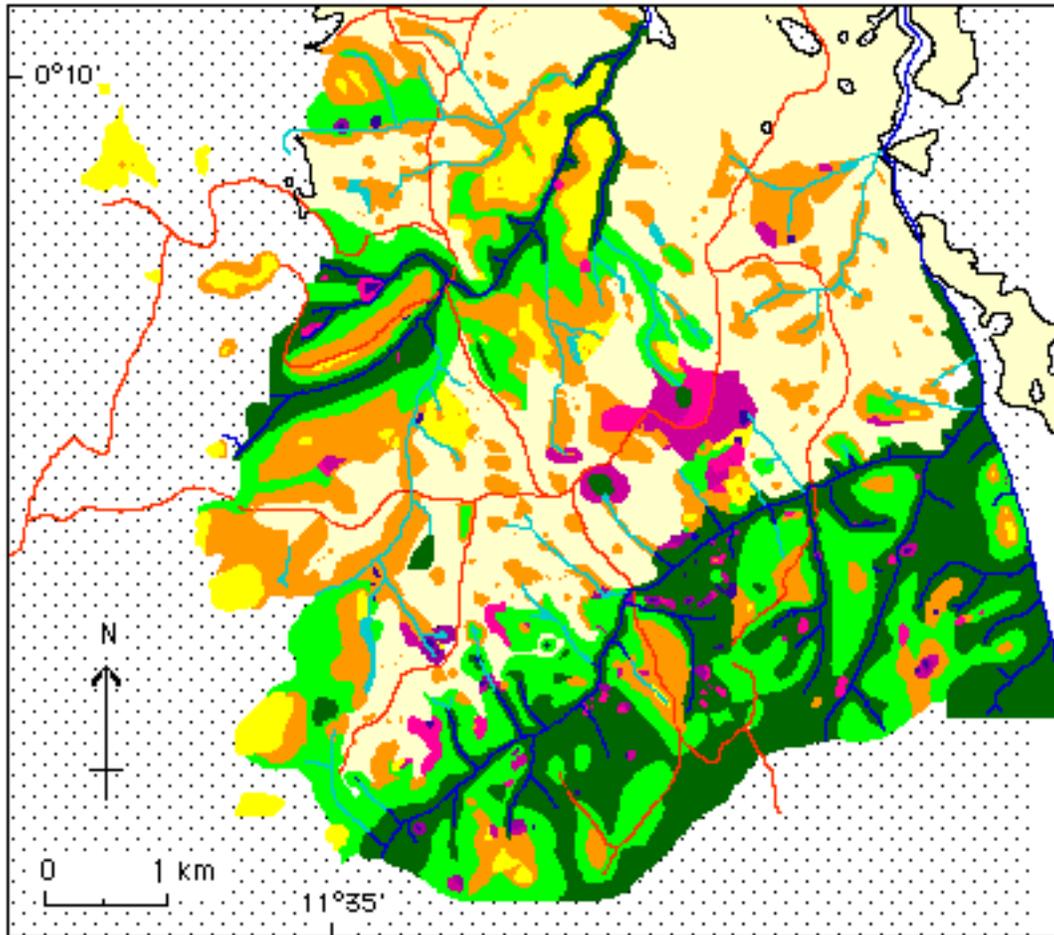


Figure 1. Map of the Lope reserve showing necessary define a second dry season (White et al., 1995). The forest at Lope is botanically diverse and varies in species composition and structure. According to White (1992), there are twenty forest types in the reserve based on the differences in vegetation structure and composition. These vegetation types are regrouped in general categories of 1. Colonizing forest, 2. Marantaceae forest, 3. Monodominant forest, 4. Rocky forest, 5. Savanna, 6. Mixed forest, and 7. Marshes. Figure 2 shows the detailed vegetation map of part of the reserve traced from aerial photography (1982) and radar images (1992) (SEGC report, 1997).



- |   |                             |   |                          |
|---|-----------------------------|---|--------------------------|
| — | Roads                       | ● | Marantaceae Forest       |
| — | Rivers with old galleries   | ● | Mixed Marantaceae Forest |
| — | Rivers with young galleries | ● | Rock outcrops            |
| ● | Marantaceae Marshes         | ● | Rocky Forest             |
| ● | Cyperaceae Marshes          | ● | Mixed Rocky Forest       |
| ● | Savanna                     | ● | Rock Edge Forest         |
| ● | Colonising Forest           | ○ | Unmapped areas           |
| ● | Monodominant Forest         |   |                          |

## Vegetation Types

By a combination of field observation and data analysis using two types of multivariate analysis (Two-way Indicator Species Analysis [TWINSPAN] [Hill, 1979a] and Canonical Community

Ordination [CANOCO] [Ter Braak, 1988 - an extension of DECORANA - Hill, 1979b])  
21 vegetation types found in different proportions on one or more of the transects were defined. Of these, six are major habitat types while others (described in full in White, 1992) cover smaller areas.

1) Savanna - vegetation maintained by annual fires, dominated by grasses, with shrubs such as *Crossopteryx ferruginea*, *Nauclea latifolia* and *Bridelia febrifuga* patchily distributed in some areas. Large continuous areas of savanna are restricted to low altitude areas, whilst small isolated patches occur either around these zones, or on hill tops with altitude of about 250-450m.

2) Colonising Forest - occurs adjacent to savannas in areas protected from fire. Shrubs such as *Psidium guineensis*, *Psychotria vogeliana* and *Antidesma vogelianum* become common as well as the trees *Aucoumea klaineana*, *Lophira alata* and *Sacoglottis gabonensis*. Ground vegetation is dominated by grasses.

3) Monodominant Forest - dominated by *Aucoumea klaineana* and *Lophira alata*, but with other characteristic species (e.g., *Klainedoxa gabonensis*). Many individuals are crooked or branch low and most are smaller than is usual for their species. Ground vegetation is sparse, but some herbs may become established, notably *Aframomum longipetiolatum* and *Megaphrynium* spp.

4) Marantaceae Forest - where trees are better formed, canopy cover is increased but dominated by *Aucoumea klaineana* and *Lophira alata*. Ground vegetation is more diverse and herbs abundant including *Haumania liebrechtsiana*, *Aframomum* sp. ?nov and *Megaphrynium* spp.

5) Mixed Marantaceae Forest - in which greater numbers of other tree species are present adding to the structural complexity and species diversity of the forest in which *Aucoumea klaineana* and *Lophira alata* are no longer dominant. Herbaceous plants of the Zingiberaceae and Marantaceae are abundant.

6) Mature Forest - increased tree diversity including species associated with more ancient forest (e.g., *Coula edulis*, *Sindoropsis le-testui*, *Desbordesia glaucescens*) (cf. de Saint Aubin, 1963). Densities of Marantaceae and Zingiberaceae herbs are low.

## Map of Forest and Savanna boundary

# Radar Backscatter and Biomass Density Validation

Summary and Conclusion

References